The Post-Bhopal and Post-9/11 Transformations in Chemical Emergency Prevention and Response Policy in the United States

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Abstract

The United States' approach to incident prevention and response at hazardous chemical facilities has undergone two major transformations in the last 20 years. The first was triggered by the Bhopal tragedy in 1984, which, along with other less severe incidents in the United States that occurred around the same time, led to major changes within the U.S. chemical industry, and to a series of Federal laws and regulations intended to prevent major chemical accidents, and to mitigate and respond to any that do occur. These laws and regulations include the Emergency Planning and Community Right-to-Know Act of 1986, and the Clean Air Act Amendments of 1990, which authorized both EPA's Risk Management Program, and OSHA's Process Safety Management standard. A more recent transformation is currently underway in the wake of the 9/11 attacks on New York and Washington. It involves the advent of various security-related requirements affecting many of the same facilities covered under the existing accident prevention rules, as well as a complete re-evaluation and

restructuring of the U.S. system for responding to national emergencies. This paper provides an overview of these transformations and their impacts.

Keywords: Chemical Accidents, Prevention, Response, Terrorism, Regulation

Introduction

Catastrophes can sometimes lead to beneficial transformations. Airline crashes, hurricanes, earthquakes, oil spills, nuclear accidents, toxic chemical releases – in the aftermath of these events, healthy organizations and societies are obligated to reexamine the way things were done, determine what went wrong, and make the necessary changes. For the worldwide chemical industry, it is well acknowledged that the December 1984 toxic chemical disaster in Bhopal, India, sparked such a transformation – a transformation in turn that brought immediate and lasting changes to the U.S. chemical industry, its interaction with local communities, and the nature and extent of its regulatory oversight by all levels of government.

Nearly two decades later, the terrorist attacks of September 11, 2001, are sparking another transformation for the U.S. chemical industry. Though no chemical facility was directly harmed in the 9/11 attacks, the subsequent changes occurring in the nation's approach to homeland security and emergency preparedness are so significant that virtually every part of the cultural and economic landscape in the United States has been affected, including vital economic sectors such as the chemical industry. And with the heightened concern over weapons of mass destruction (WMD), the U.S. federal government is assuming an ever more active role in preventing, preparing for, and responding to national emergencies involving the full spectrum of WMD agents, including hazardous chemicals.

This paper describes these transformations – post Bhopal and post-9/11 – and highlights the changes that have occurred in the chemical industry's operating

practices, its relationship with society, and national public policy for preventing, preparing for, and responding to hazardous materials emergencies in the United States.

Bhopal's Effects on the U.S. Chemical Industry

Although the disastrous loss of life at Bhopal occurred far from the United States, it immediately caused great alarm there. Union Carbide, the owner of the Bhopal facility, was an American company with similar operations in the U.S. If such a disaster could occur in India, Americans asked, why couldn't one like it also occur here? Less than one year after Bhopal, that concern was nearly realized when an accident at the Union Carbide plant in Institute, West Virginia – a chemical plant designed similarly to the Bhopal facility - led to the release of a toxic mixture of methylene chloride and aldicarb oxime, resulting in the hospitalization of 134 people living in surrounding areas (EPA, 2000). These accidents ultimately led to a series of changes within the U.S. chemical industry - new management systems, different organizational structures, and more resources would henceforth be devoted to safely managing chemical process hazards.

The first major step taken by American industry in response to Bhopal was the formation of the Community Awareness & Emergency Response (CAER) program (Reisch, 2004). The CAER program was designed by the Chemical Manufacturers Association (CMA) to improve emergency response planning in communities near chemical facilities. Both the Bhopal accident and the accident in Institute, West Virginia had highlighted shortcomings in communities' awareness of chemical

hazards and the effectiveness of local emergency procedures. Under CAER, many companies initiated dialogue with key community stakeholders, and worked more closely with communities to coordinate emergency response training with local police, firefighters, and emergency responders. CAER also established Community Advisory Panels, comprised of plant neighbors, local leaders, emergency responders, and local educators, to address community questions about chemical companies and their operations.

Even before the development of CAER in the U.S., and before Bhopal itself, chemical manufacturers in Canada had created the "Responsible Care" program. This began as a set of guiding principles for managing chemical producers' environment, safety, and health obligations (O'Connor, 2004). After Bhopal, The CAER program was incorporated into Responsible Care, and the program later matured into a life-cycle set of chemical hazard management guidelines designed to prevent serious chemical accidents from occurring. In 1988, U.S. members of the Chemical Manufacturers Association adopted the core Responsible Care guidelines from Canada, and made them mandatory for CMA members in the United States. In addition to CAER, the other Responsible Care codes required participating companies to practice pollution prevention, implement process safety measures, reduce hazards in the distribution, transportation, and storage of chemicals, train employees in health and safety risks, and take responsibility for a chemical product through its full life cycle of manufacturing, safe handling, distribution & sale, recycling, and disposal. The guidelines of the Responsible Care program have evolved since its inception two decades ago – the most notable recent change is the inclusion of a new Security code

– but today the program continues to be a cornerstone of safety practice for the U.S. chemical industry.

Changes in U.S. Chemical Safety Legislation Following Bhopal

The Bhopal and Institute accidents also led to legislative and regulatory action in the United States. In 1985, the increasing public concern over chemical hazards led the U.S. Environmental Protection Agency (EPA) to begin its Chemical Emergency Preparedness Program (CEPP) (EPA, 1987). CEPP was a voluntary program to encourage state and local authorities to identify hazards in their areas and to plan for chemical emergency response actions. In 1986, Congress adopted many of the elements of CEPP in the Emergency Planning and Community Right-to-Know Act (EPCRA). EPCRA requires U.S. states to create State Emergency Response Commissions (SERCs) and requires local communities to form Local Emergency Planning Committees (LEPCs) to prepare local emergency response plans for chemical accidents. EPCRA also requires facilities to provide LEPCs with information necessary for emergency planning, and to submit annual inventory reports and information about hazardous chemicals at the facility to SERCs, LEPCs and local fire departments. The statute also established the Toxics Release Inventory (TRI), which requires certain facilities to annually report to EPA the quantities of their emissions of toxic chemicals. The EPCRA data are available to the public and EPA maintains a national database containing the TRI toxic chemical release reports.

As its name suggests, EPCRA promotes hazard information sharing and emergency planning. However, EPCRA does not require facilities to take any actions to *prevent*

chemical accidents from occurring. Instead, EPCRA directed EPA to conduct a review of emergency systems to monitor, detect, and prevent chemical accidents, and to identify gaps in federal regulations. EPA initiated the Accidental Release Information Program (ARIP) to collect information related to chemical accidents and their causes. Serious chemical accidents continued to occur in the U.S. throughout the late 1980s, and in 1990, information from these accidents prompted Congress to incorporate two new regulatory programs into the Clean Air Act (CAA).

Section 304 of the CAA Amendments of 1990 required the Occupational Safety and Health Administration (OSHA) to develop chemical accident prevention and emergency response regulations to protect workers at hazardous chemical facilities. OSHA responded by developing the Process Safety Management (PSM) standard (29 CFR Part 1910), which places accident prevention and emergency response requirements on facilities having specified hazardous chemicals above certain threshold quantities. The PSM standard went into effect in 1992.

Section 112(r) of the amended CAA also called for EPA to develop regulations to prevent and respond to chemical facility accidents that could affect the public and environment off-site. In 1996, EPA promulgated the Risk Management Program regulations (40 CFR Part 68). The Risk Management Program is similar to OSHA's PSM standard, covering many of the same toxic and flammable chemical substances, and requiring a similar set of accident prevention requirements. These requirements include using written operating procedures, providing employee training, ensuring ongoing mechanical integrity of equipment, analyzing and controlling process hazards, and the like. The OSHA PSM standard and the EPA Risk Management

Program were the first U.S. Federal regulations specifically designed to prevent major chemical accidents that could harm workers, the public and the environment.

Although the accident prevention program requirements of the OSHA PSM standard and EPA Risk Management Program are similar, the EPA program contains a number of additional requirements that go beyond the PSM standard. These include:

- Facilities must prepare a history of accidental releases occurring over the past five-years.
- Facilities must perform an Offsite Consequence Analysis (OCA) - an analytical estimate of the potential consequences to the public and environment around the facility of hypothetical worst case and alternative accidental release scenarios.
- Facilities must submit a summary report, called a Risk Management Plan (RMP), to the EPA. The RMP contains the facility's five-year accident history, a summary of its accidental release prevention program, its offsite consequence analysis, and a summary of its emergency response plan. The CAA requires EPA to make all RMPs available to state and local governments and the public, although it also authorizes restrictions on access to the offsite consequence analysis portion of the plan. Facilities must update their RMP at least every five years, or more frequently when certain changes occur.

The Risk Management Program regulation went into effect in 1999, and EPA received RMPs from approximately 15,000 U.S. chemical facilities. The majority of these were submitted in electronic format, enabling EPA to construct a relational

database, called RMP*Info, containing the plans. Today, RMP*Info is probably the most comprehensive database on chemical facility hazards in existence.

Without the benefit of the data contained in RMP*Info, one might assume that major chemical hazards are largely confined to those facilities that manufacture industrial chemicals. But the RMP*Info data make it readily apparent that chemical manufacturing facilities are just one end of a wide spectrum of facility types that contain large quantities of hazardous chemicals. Industrial categories with the largest number of facilities reporting RMPs to EPA are listed in Table 1. As this table indicates, industrial categories such as farm supply wholesalers, water supply and irrigation, wastewater treatment, and refrigerated warehousing and storage have the largest numbers of RMP facilities.

The Debate over Public Right-to-Know

In 1996, in anticipation of receiving thousands of RMPs, EPA commissioned a Federal Advisory Committee workgroup to study the issues related to creating an electronic database of RMPs, and making that database available to the public (EPA, 2000). That group recommended that EPA make most RMP information available to the public via the Internet. EPA favored this approach because it anticipated that hazardous chemical information, if conveniently available to the public in an easily understandable format, would be used by various sectors of the public to influence facility behavior to a greater extent than the regulatory requirements alone. This approach had been successful with implementation of the earlier EPCRA legislation.

However, some members of the advisory group, along with chemical industry and federal security agency representatives, raised concerns about public access to "Offsite Consequence Analysis" (OCA) information contained in RMPs. OCA information is the portion of an RMP detailing hypothetical estimates of worst-case and alternative release scenarios from chemical facilities. The main concern was that providing easy, anonymous access to this information via the Internet would allow criminals or terrorists to misuse the information in order to target facilities for attack.

To address these concerns, in August 1999, Congress passed the Chemical Safety Information, Site Security, and Fuels Regulatory Relief Act. This law attempted to strike a balance between competing concerns, by authorizing restrictions on public access to the portions of RMPs containing OCA information, while still guaranteeing that any member of the public could obtain access to that information for at least a limited number of facilities. Under the law, EPA and the Department of Justice (DOJ) jointly published regulations in August 2000 (40 CFR Chapter IV) allowing public access to paper copies of the OCA information sections of RMPs only in designated Federal "reading rooms." EPA and DOJ established approximately 50 OCA information reading rooms nationwide. At a reading room, a member of the public may view paper copies of the OCA information sections of RMPs for all regulated facilities in the person's locality, and view up to 10 OCA information sections per month for regulated facilities nationwide. The regulations also allow full access to the OCA information sections of RMPs by federal, state, and local government officials, but prohibit these officials from disclosing those sections to the public except through state and local reading rooms meeting federal requirements.

The Effects of 9/11

The United States had experienced terrorist attacks against its interests abroad and on U.S. soil prior to September 11, 2001. Some of these had resulted in significant numbers of deaths and injuries. Terrorists destroyed the U.S. Marine barracks in Lebanon in 1983, killing 241. In 1998, terrorists bombed U.S. embassies in Tanzania and Kenya, killing 224, including twelve Americans. The U.S.S. Cole, a U.S. Navy frigate, was attacked in October 2000, in the port of Aden, Yemen, killing 17. Domestically, terrorists had already bombed the World Trade Center once in 1993, killing 5 and injuring more than 600. In 1995, the bombing of the Oklahoma City federal building caused more deaths (168) than any prior act of terrorism on U.S. soil (DOJ, 2000). But none of these events approached the scale and severity, or had the numerous and lasting effects on American society, of the coordinated attacks that occurred on September 11, 2001.

One consequence of the increased threat of terrorism on U.S. soil, and increased public awareness of that threat, has been to change the balance in the ongoing debate over the extent of the public's right to know information about chemical facility hazards. Although the 9/11 attacks targeted financial and military centers, government officials have long recognized that other domestic targets, including chemical facilities, could potentially be vulnerable to terrorism. In April 2000, DOJ published a study concluding that a chemical plant could be converted into a WMD relatively easily:

> "In recent years, criminals have with increasing frequency attempted to obtain or produce WMD precisely because such weapons are engineered to cause wide-scale damage to life and property. However, traditional means of creating or obtaining WMD are generally difficult to execute. In contrast, breaching a containment vessel of an industrial facility with an explosive or otherwise causing a chemical release may appear relatively simple to such a terrorist." (DOJ, 2000).

EPA Analysis of OCA information in RMPs had indicated that many chemical facilities in the United States had worst-case accident scenarios that could potentially affect many thousands of people in nearby communities (Belke, 2001). After the 9/11 attacks, although it was not developed for the purpose, OCA information in RMPs became an important tool for the Federal government in identifying chemical facilities that might be attractive targets for terrorism. However, if government officials could use it for that purpose, then so could terrorists. In response to concerns that other portions of the RMP might also provide information useful to terrorists, EPA temporarily removed RMP*Info from the Internet until further analysis of the security implications of it and other government information could be completed.

The Chemical Industry – a Component of Critical Infrastructure

EPA's decision to temporarily remove RMP data from the Internet is representative of a more general trend in the U.S. toward greater information security since 9/11. To a great extent, this trend results from post-9/11 legislative action. For example, Public Law 107-296, which established the U.S. Department of Homeland Security, also

prohibits release of sensitive security information that is voluntarily submitted to DHS and not otherwise required to be submitted under Federal law. Other post-9/11 federal actions similarly endeavor to protect sensitive security information to the extent allowed by law.

But protecting sensitive information alone is not sufficient to prevent domestic terrorism. Government officials remain concerned about the potential for mass casualties, economic loss, and social disruption of terrorist attacks against domestic infrastructure targets. In the *National Strategy for Homeland Security*, the Bush Administration highlighted various sectors of the economic and civil infrastructure that pose such concerns. A later subsidiary document, entitled the *National Strategy for the Physical Protection of Critical Infrastructures and Key Assets*, outlined a sector-based approach to identification and protection of critical infrastructures and key assets, defined as "vital to our national security, governance, public health and safety, economy, and public confidence." The USA Patriot Act further defines these as, "systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters."

Designated critical infrastructure sectors include agriculture & food, water, public health, emergency services, defense industrial base, telecommunications, energy, transportation, banking and finance, chemical and hazardous materials, and postal and shipping. In each of these sectors, federal, state, and local government officials are now actively working with sector representatives to enhance security and improve

domestic emergency preparedness. This transition is not without cost – both the public and private sectors have increased security related expenditures since 9/11. Although U.S. firms generally do not publicly report spending on security (Hobijn, 2002), various studies have estimated increased annual private sector homeland security-related costs – estimates ranging from $10 billion (O'Hanlon et al, 2002), to $55 billion (Council of Economic Advisors, 2002), to in excess of $127 billion (Hobijn, 2002). Federal state, and local government homeland security spending has also increased apace.

Chemical facilities are present in several of the designated critical infrastructure sectors, including chemical and hazardous materials, agriculture & food, water, energy, and defense. Consequently, the chemical industry is fully involved in this transformation. Many hazardous chemical facilities have already invested in enhancements to traditional physical security measures such as perimeter fences and lighting, security guards, access controls and the like, as well as measures to improve operational security, employee screening, and security of electronic systems. Some facilities have also taken steps to reduce their level of inherent risk by employing inherently safer production technologies or substituting less hazardous chemicals for highly toxic chemicals.

These changes have frequently impacted or overlapped with safety management programs that are already in place. For example, shortly after 9/11, one of the first steps taken by the American Chemistry Council (ACC, formerly the Chemical Manufacturers Association), was to add a new Security Code to the existing Responsible Care program, and issue site security guidelines for the U.S. chemical

industry. The new Security Code requires ACC member companies to conduct a security vulnerability assessment, implement security enhancements, and independently verify those enhancements using a third-party audit. Other trade associations representing industries that manufacture or use hazardous chemicals have implemented similar non-regulatory programs to enhance security.

Chemical Facility Security Legislation

In addition to voluntary private-sector efforts to enhance security, federal laws and regulations have played an important role in chemical facility security. For some facilities, previously existing legislation such as the CAA (i.e., the EPA Risk Management Program), and EPCRA may help to promote security by ensuring that chemical processes are properly operated and maintained, and that emergency response plans are in place and up-to-date. However, neither EPCRA nor the CAA explicitly address chemical releases due to terrorism or require specific security measures.

Two U.S. laws enacted since September 11, 2001 do mandate security requirements for some categories of chemical facilities. The Public Health Security and Bioterrorism Preparedness and Response Act of 2002 requires larger community water utilities (many of which use large quantities of hazardous chemicals such as chlorine, sulfur dioxide, and ammonia) to conduct security vulnerability assessments, implement emergency preparedness and response plans, and submit the vulnerability assessments to EPA. This law also requires EPA to study methods to prevent, detect, and respond to terrorist threats to the safety and security of water distribution systems

and infrastructure. A second new law, the Maritime Transportation Security Act, requires ports, vessels, and port facilities to conduct vulnerability assessments, develop transportation security plans, and develop security incident response plans. For chemical facilities located within a port, this law requires specific security measures.

However, only a fraction of U.S. hazardous chemical facilities will be covered under either of these new laws. Legislation that would explicitly and broadly require chemical facilities to implement security measures has been much debated since 2001. As of the date of this writing, there is no U.S. law broadly requiring chemical facilities to implement enhanced security measures, although various legislative proposals are currently being considered (Schierow, 2004).

Transforming National Emergency Response

In addition to its efforts to prevent accidental and terrorist-caused chemical releases, and to identify and protect domestic infrastructure targets in general from attack, the U.S. government has undertaken a major effort since 9/11 to improve its ability to respond to national emergencies. Prior to 9/11, the nation's approach to national incident response focused mainly on natural disasters and major accidents, rather than disasters caused by terrorism. Under the old system, a patchwork of different Federal special-purpose incident management and emergency response plans had evolved to respond to different types of major incidents, and to support state and local incident response efforts. Under this structure, any of sixteen different Federal agencies would

be called on to lead or assist in the response to a major emergency, depending on the nature of the emergency and the capabilities and expertise of the particular agency. Some parts of this structure are codified in Federal laws, such as the Clean Water Act (1972) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (1980). Under these plans, for example, EPA and the Coast Guard respond to major hazardous materials incidents and oil spills; EPA responds to approximately 300 such incidents each year, and provides technical assistance during many others.

In the wake of 9/11, this system is being transformed to improve the nation's ability to respond to terrorism, including the full range of chemical, biological, nuclear, radiological, or high explosive threats. One of the first steps toward this goal was the Homeland Security Act of 2002, which established the Department of Homeland Security (DHS). The creation of DHS involved the largest reorganization of the U.S. Federal government in the last 50 years. DHS combines, under a single agency, the majority of 22 formerly independent federal departments and agencies into a single department with the mission to prevent terrorist attacks within the United States, reduce the vulnerability of the United States to terrorism, natural disasters, and other emergencies, and minimize the damage and assist in the recovery from terrorist attacks, natural disasters and other emergencies.

An important initiative toward meeting these goals is the development and implementation of a National Response Plan (NRP), and a new National Incident Management System (NIMS). The NRP and NIMS align the old U.S. national response system into a more cohesive structure that integrates the capabilities and

resources of various governmental jurisdictions, incident management and emergency response disciplines into a national framework for domestic incident management.

The NIMS provides a nationwide template enabling Federal, State, local, and tribal governments, and private sector and nongovernmental organizations to work together to prevent, prepare for, respond to, and recover from domestic incidents regardless of cause, size, or complexity. The NRP will incorporate and supersede previous national response plans, and become the Federal all-hazards plan that provides the structure and mechanisms for national-level policy and operational direction for domestic incident management. The design of the NRP will allow either partial or full implementation, in the context of a threat, or in anticipation of or response to a significant event. This selective implementation through the activation of one or more of the system's components is intended to allow maximum flexibility to meet the unique requirements of the situation at hand and enable effective interaction with various non-Federal entities.

Conclusion

Events on the scale of the Bhopal disaster or the 9/11 attacks have been rare. This makes it difficult to determine if particular changes that have been made or policy alternatives under consideration will be successful in preventing or responding to future events – whether those events involve accidents or terrorism. So there are many questions that remain to be answered. Have facilities implemented measures that will be successful over the long term in preventing accidents and deterring terrorist attacks? Are facilities and local communities adequately prepared to respond to a major accident or terrorist incident? Have the lessons from incidents such as

Bhopal and 9/11 been properly learned and incorporated into planning, preparedness, and response activities at the national, state, and local levels? Have the public and private sectors devoted the appropriate amounts and types of resources to chemical security and chemical safety? Are there unintended negative consequences of any of our policies?

In addressing these and other related questions, the tradeoffs that are inherent in selecting among policy options become apparent - homeland security and chemical risk management are generally complementary interests, but occasionally they may come into conflict. This is illustrated by the difficulty in evaluating the relative risks and benefits associated with public access to chemical hazard information, as well as the obstacles to reaching agreement on chemical plant security legislation. Without any widely accepted method of valuing potentially competing risks and benefits, the policy alternatives preferred by one group may be less acceptable to another. Ultimately, resolving these issues in a manner that achieves the greatest benefits for the most people will require sustained and cooperative efforts on the part of government, industry, and local communities.

Chemical Emergency Preparedness and Prevention – History of U.S. Legislation and Industry Initiatives: 1985 - 1999

1985 – CMA Community Awareness & Emergency Response (CAER) program

1986 – Emergency Planning and Community Right-to-Know Act

1988 – U.S. Chemical Industry adopts Canadian Responsible Care code

1990 – Clean Air Act Amendments establish OSHA PSM standard and EPA RMP program

1992 – OSHA PSM standard published

1996 – EPA RMP rule published

1999 – First 15,000 Risk Management Plans submitted to EPA by U.S. chemical facilities; Chemical Safety Information, Site Security, and Fuels Regulatory Relief Act passed

Industrial Category	Number of RMP Facilities
Farm supplies wholesalers	4357
Water supply and irrigation systems	2000
Sewage treatment facilities	1421
Refrigerated warehousing and storage	576
Natural gas liquid extraction	482
Other chemical and allied products wholesalers	371
Farm product warehousing and storage	342
Support activities for crop production	305
Plastics material and resin manufacturing	255
All other basic organic chemical manufacturing	252
Liquefied petroleum gas (bottled gas) dealers	242
Poultry processing	226
Soil preparation, planting, and cultivating	194
All other basic inorganic chemical manufacturing	193
Petroleum refineries	168
Fossil fuel electric power generation	140
Industrial gas manufacturing	135
General warehousing and storage facilities	131
Petroleum bulk stations and terminals	128
Meat processed from carcasses	124

Table 1: Most commonly reported industrial categories in RMP*Info database (from Kleindorfer, et al, 2003)

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Public Law 106-40, Chemical Safety Information, Site Security, and Fuels Regulatory

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Public Law 107-56, The USA Patriot Act, October 26, 2001.

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